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(71) Applicant (*for all designated States except US*): HEALTH HERO NETWORK, INC. [US/US]; Suite 111, 2570 West El Camino Real, Mountain View, CA 94040 (US).

(72) Inventor; and
(75) Inventor/Applicant (*for US only*): BROWN, Stephen, J. [-/US]; 3324 Woodside Road, Woodside, CA 94062 (US).

(74) Agent: GRAHAM, Lawrence, D.; Black Lowe & Graham, PLLC, 816 Second Avenue, Seattle, WA 98104 (US).

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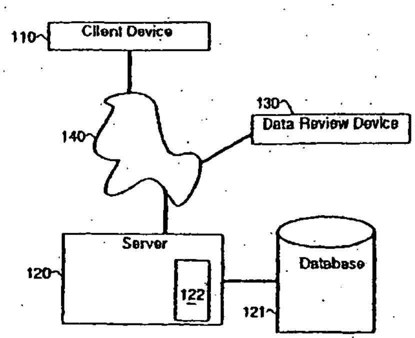

(57) Abstract

The invention provides for modeling and scoring risk-assessment and a set of insurance products derived therefrom. Risk indicators are determined at a selected time. A population is assessed at that time and afterward for those risk indicators and for consequences associated therewith. Population members are coupled to client devices for determining risk indicators and consequences. A server receives data from each client, and in response thereto and in conjunction with an expert operator, (1) reassesses weights assigned to the risk indicators, (2) determines new risk indicators, (3) determines new measures for determining risk indicators and consequences, and (4) presents treatment options to each population member. The server determines, in response to the data from each client, and possibly other data, a measure of risk for each indicated consequence or for a set of such consequences. The server provides this measure with regard to each population member, or with regard to population subsets. The expert operator uses this measure to determine either (1) an individual course of treatment, (2) a resource utilization review model, (3) a risk-assessment model, or (4) an insurance pricing model, for each individual population member or for selected population subsets. Information requested by the client, information determined and presented by the server, and responsive measurements, are adapted dynamically to changing population aspects or changing population membership, or of an external environment having relevance to the population.

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Title of the Invention

Dynamic Modeling and Scoring Risk Assessment

Background of the Invention

1. *Field of the Invention*

This invention relates to computer systems and data structures for modeling and scoring risk assessment, such as insurance risk.

2. *Related Art*

In the insurance industry and in other fields in which risk is assessed (including such diverse fields as medical treatment, financial modeling and portfolio management, and environmental impact regulation), it is known to develop and use a risk-assessment model of a population. The risk-assessment model provides a technique for determining which population members are more subject or less subject to particular risks (or to an aggregate of risks) than the norm for that population. For example, in life insurance underwriting, it is known to evaluate past and present medical data so as to determine what insurance premium the underwriter wishes to charge.

While these known methods generally achieve the goal of assessing risk for particular individuals in comparison to a population norm, they have the drawback of making a risk assessment that is fixed at a particular point in time. That is, these risk-assessment models rely on static data, in particular (1) static data about the individual population member, (2) static data about the population norm, and (3) static data about risks associated or correlated with the data about the individual population member. However, risk for individual population members depends not only on their present data, but also on their future data, including both data about behavior and environment.

A first type of problem for the known art includes those individuals that have a progressive disease or degenerative condition, in which the disease or condition

progresses at a rate that is responsive to behavior or environment of the individual. For such individuals, risk is more accurately evaluated as a function of behavior measured over time and environment measured over time, rather than as a static value that is a function only of present behavior and environment. For example, a first patient with diabetes can proceed with relatively small risk if that first patient is aware of and active in management of behavioral and environmental risk factors. In contrast, an otherwise identical second patient will have significantly greater risk if that second patient is either unaware of, or unable or unwilling to take charge of, behavioral and environmental risk factors.

Related to this first type of problem is the problem of determining trends for individual risk-assessment. For example, an individual with a history of diabetes may suffer a significant increase or decrease in effects thereof, due at least in part to that patient's actions with regard to behavioral and environmental risk factors. Similarly to the first type of problem, that individual will be rationally assessed a significantly greater or lesser risk than originally, if the new facts were known to the underwriter. Such trends may differ significantly from any trends that might have been discerned from past medical history alone; such trends may also themselves involve genetic, environmental, or behavioral components, or some combination thereof.

A second type of problem for the known art includes individuals whose risk-assessment significantly changes due to the vicissitudes of their life trajectory. This can

include progression of a disease or condition, responsive at least in part to behavioral or environmental factors. For a more striking example, an individual may suffer a myocardial infarction, or become infected with an HIV variant. Similarly to the first type of problem, that individual would be rationally assessed a significantly greater risk than originally, if the new facts were known to the underwriter. Alternatively, an individual may be successfully treated for a "curable" disease such as Hodgkin's disease or some forms of cancer. Such vicissitudes of life trajectory may themselves involve genetic, environmental, or behavioral components, or some combination thereof.

A third type of problem for the known art includes individuals who significantly change their behavior or environment, particularly when those individuals are susceptible to the elements of their behavior or environment they change. For example, an individual with diabetes can determine to alter their diet favorably or unfavorably. For a more striking example, an individual may take up smoking or skydiving as habits. That individual will become a significantly greater risk than the underwriter originally assessed.

Moreover, new medical research may indicate risk factors that were not known at the time risk for the individual was originally assessed. These could include past medical information not known at the time to be important, tests available in the future for risk factors not known at the time at all, or changes in the medical history of the individual that place that individual in different risk factor categories. Such past medical

information or risk factors may themselves involve genetic, environmental, or behavioral elements, or some combination thereof.

Accordingly, it would be advantageous to collect feedback from individual population members, whether on a periodic or aperiodic basis, and whether prompted by selected events or not. Such feedback would allow underwriters or other risk-assessment or risk-management personnel to determine specific risk-related information about each individual population member, and to adjust (such as to make more accurate or precise) insurance models and risk-assessment models to fit the new data. Such feedback enables the advantage of providing information about the time-varying nature of individual measures which can be used in the dynamic risk assessment model presented in the present invention. For instance, a weight gain of 10 pounds per year, an increase in diastolic blood pressure of 10 points per year, and a increase of cholesterol of 10 points per year could be tracked over time and would yield health risk information.

To achieve this advantage, a first aspect of the invention is that feedback is collected by a client-server system in which data is requested or required from population members. A server device, responsive to a risk-assessment model, prompts a client device supplied to population members to request information from population members, in order to determine whether aggregate measures or individual measures of risk-assessment remain in coherence with the model. The client device collects the data and supplies it to the server device, which can, in response to dynamically collected data,

adjust the model, adjust risk assessments for selected population members (or groups thereof), or determine further information to collect from population members.

Upon achieving this advantage, a second aspect of the invention is to provide a set of superior risk-assessment models and insurance models in response to the feedback.. These superior risk-assessment models and insurance models can include information about the risk-related behavior, risk-related trends, or forward-looking risk-assessment of selected individuals or selected subsets of the population. These superior risk-assessment models and insurance models can be responsive to data-mining techniques described in related patent applications, described below, hereby incorporated by reference as if fully set forth herein. These superior risk-assessment models can also incorporate known scientific information regarding health risk or disease progression, such as well-determined correlations of risk factors and disease incidence or progression from large research studies, or well-known shape of 5-year survival curves for patients having specific types of cancer.

Accordingly, it would also be advantageous to provide a set of techniques for modeling and scoring risk-assessment and a set of insurance products derived therefrom, using dynamic assessment of risk indicators and associated consequences for a population. This advantage is achieved in an embodiment of the invention in which a population (such as a population of medical patients) is assessed both at a selected time and afterward for those risk indicators and for consequences associated therewith. A

client-server system provides dynamic data collection and analysis, dynamic risk assessment in response to that data collection and analysis, and dynamic treatment options and utilization review for each population member.

Summary of the Invention

The invention provides a set of techniques for modeling and scoring risk-assessment and a set of insurance products derived therefrom. A set of risk indicators (such as medical risk factors for individuals) is determined at a selected time. A population (such as a population of medical patients) is assessed at the selected time and afterward for those risk indicators and for consequences associated therewith. For example, the population can be periodically assessed for correlation between smoking and heart disease, for correlation between alcohol use and heart disease, and for multivariate correlation of a plurality of such indicators and consequences.

In a preferred embodiment, selected population members are each coupled to client devices for determining risk indicators and consequences. For example, where the population is a set of medical patients, the client device can include a local device for asking medical, psychological and life-style questions, and for measurement of medical parameters, for each of those patients. A server device receives data from each client device, and in response thereto, can (1) reassess weights assigned to the risk indicators, (2) determine new significant risk indicators, (3) determine new significant measures for

determining risk indicators and consequences, and (4) present treatment options to each population member. The server device can perform these tasks in conjunction with an operator, such as a skilled medical professional, risk-management assessor, or other expert.

The server device can determine, in response to the data from each client device, and possibly in response to other data (such as provided by the expert operator), a measure of risk for each indicated consequence or for a set of such consequences. The server device can provide this measure with regard to each population member, or with regard to population subsets (selected either with regard to the known risk indicators or other indicators). The expert operator can use this measure to determine either (1) an individual course of treatment, (2) a resource utilization review model, (3) a risk-assessment model, or (4) an insurance pricing model, for each individual population member or for selected population subsets.

In a preferred embodiment, information requested by the client device, information determined and presented by the server device, and measurements determined in response thereto, can be adapted dynamically to changing aspects or changing membership of the population, or of an external environment having relevance to the population. For example, medical treatment or risk-assessment models can be dynamically adapted to an aging population or to biomedical advances with regard to detection or treatment of medical conditions for members of that population.

Brief Description of the Drawings

Figure 1a shows a block diagram of a system for data collection and interpretation for a population. Figure 1b shows details of the client device 110 shown in figure 1a. Figure 1c shows devices that may be connected to client device 110. Figure 1d shows details of the data review device.

Figure 2 shows a response diagram of consequences to risk indicators, for statistical aggregates of the population, which can be selected in response to dynamic data collection and analysis.

Figure 3a shows a process flow diagram of a method for dynamic data collection to be performed by the system; verification of model, updating a model, or creating a new model, and re-evaluation of risk assessment. Figure 3b shows a process flow diagram of the step of dynamic data collection. Figure 3c shows a process flow diagram of the step of verification of the model. Figure 3d shows a process flow diagram of the step of updating the existing model.

Figure 4a shows a process flow diagram of a method for dynamic data analysis to be performed by the system. Figure 4b shows a process flow diagram for data mining.

Figure 5 shows a response diagram of consequences to risk indicators, for statistical aggregates of the population, with data collected from an individual at different points of time also plotted.

Figure 6 shows a process flow diagram for a method of providing treatment options and information to each patient based on the data provided to the server.

Detailed Description of the Preferred Embodiment

In the following description, a preferred embodiment of the invention is described with regard to preferred process steps and data structures. Embodiments of the invention can be implemented using general purpose processors or special purpose processors operating under program control, or other circuits, adapted to particular process steps and data structures described herein. Implementation of the process steps and data structures described herein would not require undue experimentation or further invention.

Related Applications

Inventions described herein can be used in combination or conjunction with inventions described in the following patent applications:

- Application Serial No. 09/041,809 filed in the name of Stephen J. Brown, titled "Phenoscope and Phenobase," assigned to the same assignee, attorney docket number RYA-136 and related application serial no. 08/946,341.
- Application Serial No. 07/977,323, filed November 17, 1992 in the name of Stephen J. Brown, and issued April 26, 1994 as Patent No. 5,307,263, titled "Modular Microprocessor Based Health Monitoring System," assigned to the same assignee; and subsequent Continuation-in-Part applications including Application Serial No. 08/481,925 filed June 7, 1995 and Application Serial No. 08/233,397 filed April 26, 1994, and a Continuation-in-Part application filed August 19, 1998, serial number unknown.
- Application Serial No. 09/127,404 filed July 31, 1998 in the name of Stephen J. Brown, titled "Modular Microprocessor Based Diagnosed Measurement System for Psychological Conditions", and previous applications of which this is a continuation including Application Serial No. 08/843,495, filed April 16, 1997, which is a continuation of Application Serial No. 08/682,385 filed July 15, 1996, which is a continuation of Application Serial No. 08/479,570 filed June 7, 1995, which is a continuation of Application Serial No. 08/233,674 filed April 26, 1994.
- Application Serial No. 08/666,242 filed June 20, 1996, in the name of Stephen J. Brown, titled "Health Management Process Control System", assigned to the same assignee, attorney docket number RYA-114.

- Application Serial No. 08/669,613 filed June 24, 1996, in the names of Stephen J. Brown and Erik K. Jensen, titled "On-line Health Education and Feedback System Using Motivational Driver Profile Coding and Automated Content Fulfillment", attorney docket no. RYA-115.
- Application Serial No. 08/732,158 filed October 16, 1996, in the name of Stephen J. Brown, titled "Multiple Patient Monitoring System for Proactive Health Management", attorney docket no. RYA-116.
- Application Serial No. 08/814,293 filed March 10, 1997, in the name of Stephen J. Brown, titled "On-Line Health Education Using Composites of Entertainment and Personalized Health Information", attorney docket no. RYA-119.
- Application Serial No. 08/847,009 filed April 30, 1997, in the name of Stephen J. Brown, titled "Monitoring System for Remotely Querying Individuals", attorney docket no. RYA-126.
- Application Serial No. 08/975,774 filed in the name of Stephen J. Brown, titled "Multi-User Remote Health Monitoring System", attorney docket no. RYA-131.

and

- Application Serial No. ____, Express Mail Mailing No. EI027453472US, filed September 23, 1998, in the name of Stephen J. Brown, titled "Reducing Risk

Using Behavioral and Financial Rewards," assigned to the same assignee, attorney docket number HHN-004.

These applications are hereby incorporated by reference as if fully set forth herein.

System for Data Collection

Figure 1a shows a block diagram of a system for data collection and interpretation for a population.

Referring to figure 1a, a system 100 includes a client device 110, a server device 120 including a program memory 122 and database of patient information 121, and a data review element 130. These devices are connected via a communication channel, such as a communication network as in known in the art and more fully described in the Phenoscope and Phenobase patent (U.S. 09/041,809) and related patent application serial no. 08/946,341 and other patents and patent applications previously incorporated by reference.

Referring to figure 1b, the client device 110 is disposed locally to a patient 111, and includes an output element 112 for presenting information to the patient 111, and an input element 113 for entering information from the patient 111. As used herein, "locally" refers to a logical relationship to the patient 111, and does not have any necessary implication with regard to actual physical position. In a preferred embodiment,

the client device 110 is relatively small or compact, and can be disposed on a night table or otherwise near the patient 111.

The output element 112 includes a display screen 114, on which questions and suggested answers can be displayed for the patient 111, so as to facilitate information entry, or on which instructions can be displayed for the patient 111, so as to instruct the patient 111. The output element 112 can also include a speaker 115, so as to present information in conjunction with or in alternative to the display screen 114. The output element 112 can also include a bell or other sound element, or a bright light 119 or a flag, so as to alert the patient 111 that the client device 110 has questions or information for the patient 111.

The input element 113 includes a plurality of buttons 116A-D for entering information, preferably such as described in the patent applications referenced and incorporated by reference above.

The input element 113 can also include one or more data ports 117A-D for entering information from other devices. Referring to figure 1c, such other devices 118 can include a medical measurement device, such as a blood glucose meter or a blood pressure monitor. Such other devices 118 can include a dispensing device for medication.

Such other devices 118 can also include a general purpose or special purpose client workstation, such as a personal computer or a hand-held digital calendar.

The server device 120 is disposed logically remotely from the patient 111, and includes a database 121 of information about the patient 111 and about other patients in a related population thereof. As used herein, "remotely" refers to a logical relationship to the patient 111, and does not have any necessary implication with regard to actual physical position.

The server 120 and patient profile database 121 are preferably accessible by means of a standard network connection such as a world wide web connection. Server 120 and database 121 may comprise single stand-alone computers or multiple computers distributed throughout a network.

Referring to figure 1a and figure 1d, the data review element 130 is disposed logically remotely from the patient 111, and includes an interface 131 disposed for use by an operator 132. The operator 132 can comprise medical personnel, a device operated by medical personnel, or a similar device, capable of interacting with the interface 131 so as to receive information from the data review element 130 and possibly to enter information into the data review element 130. Information entered into the data review

element 130 can be entered for ultimate transmission to the server device 120 or to the client device 110.

The data review element 130 is preferably a personal computer, remote terminal, web TV unit, Palm Pilot unit, interactive voice response system, or any other communication technique. The data review element functions as a remote interface for entering in server 120 or client device 110 messages and queries to be communicated to the individuals.

Other and further information regarding the system 100 is shown in the following pending patent applications and in other patent applications referenced above:

- Application Serial No. 09/041/809, filed in the name of Stephen J. Brown, titled "Phenoscope and Phenobase," assigned to the same assignee, attorney docket number RYA-136 and related application serial no. 08/946,341.

and

- Application Serial No. ________, Express Mail Mailing No. EI027453472US, filed September 23, 1998, in the name of Stephen J. Brown, titled "Reducing Risk Using Behavioral and Financial Rewards," assigned to the same assignee, attorney docket number HHN-004.

These applications are hereby incorporated by reference as if fully set forth herein.

Aggregate Responses to Risk Indicators

Figure 2 shows a response diagram 200a of consequences to risk indicators, for statistical aggregates of the population, which can be selected in response to dynamic data collection and analysis. It is to be noted that figure 2 shows curves that are collapsed to 2-dimensions, in a preferred embodiment the curves are N-dimensional, with N>2.

A diagram 200a includes a first axis X 201 and a second axis Y 202. The diagram shows a first response curve R0 210 showing a normal trajectory for vital function and life expectancy of an individual or subpopulation of the population. The first axis X 201 indicates a relative time, as measured toward a right side of the diagram. The scale of the first axis X 201 is a relative time whose initial left hand point may be undetermined. As to a first response curve R0 210, the second axis Y 202 represents a measure of vital function and life expectancy.

A diagram 200a also shows a second response curve S0 220 showing a normal trajectory for a measure of expected medical expense or risk for an individual or subpopulation of the population. The first axis X 201 indicates a relative time as for a first response curve R0 210. As to a second response curve S0 220, the second axis Y 202 shows increasing expense or risk as measured toward the top of the diagram.

In the first response curve R0 210, the normal trajectory for vital function and life expectancy for a typical individual in the population shows that as time progresses, vitality and life expectancy are expected to decrease. This general concept is known in the art of actuaries. It is to be noted that the shape shown by the first response curve R0 210 is an example shape; for instance, it is known that for certain curable cancers, risk increases, then levels off after a certain length of time such as a 5-year survival rate, then later in life risk increases due to other causes.

The first response curve R0 210 includes a number of points with error bars 211 about the response curve R0 210. All of the points 211 are at an identical value, V0, of the second axis Y 202, with identical error bars. Any one of the points represents a single measurement of vitality taken for an individual. Given any single measurement of vitality, it is difficult to determine where along the second axis X 201, that is, where along the trajectory the individual is. Of particular interest is how close to a rapid decline in vitality or increase in risk the individual is. The points 211 show the several places along the curve where the individual might be placed, based on this single measurement of vitality. Because the response curve R0 210 is slowly varying through much of the time, that is, the values of vitality and life expectancy clustering in a selected region of the second axis Y 202, shown by the bracket 203, and due to margins of error in both the measurement as well as the response curve, there are several positions along the curve where an individual with a specific measurement might be; these several positions are shown by points 211.

By contrast, if measurements are taken for an individual at more than one point in time, greater information is present, and in particular trends may be discerned which yield more information about where on the curve an individual is. This ability to discern trends is greater when curves in N-dimensions are considered. For instance, an individual whose excess weight has slowly climbed in conjunction with slowly increasing cholesterol, blood pressure, stress levels and family medical history would be placed in a greater risk category although the individual measures of, for instance, cholesterol, might be within a normal range.

Similarly, in the second response curve S0 220, the normal trajectory for expected medical expense and risk for that typical individual shows that as time progresses, expected medical expense and risk are expected to increase. This general concept is also known in the art of actuaries. It is to be noted that the shape shown by the second response curve R0 220 is an example shape; for instance, upon diagnosis of a disease the expense may climb, but if the patient is cured the expense will level off.

Similarly, the second response curve S0 220 includes a number of points 221 on the response curve S0 220, showing possible places that an individual in the population with measurement of expense or risk, with value E0, might be. Because most of the values of response curve S0 220 cluster in a selected region of the second axis Y 202 shown by the bracket 204, it is difficult to know where along curve S0 220 an individual

with measurement E0 should be placed. This is due to both possible error in measurement of E0 as well as uncertainty in the exact "true" position and shape of curve S0 220. As for curve R0 210, measurements of expense or risk taken over time will yield useful information about where on the curve S0 220 an individual is.

When subsets of the population are selected in response to specific risk factors, the statistical aggregates of the population can differ substantially from the aggregate response curves R0 210 and S0 220 for the entire population. The diagram 200a shows response curves R1a 212 and R1b 213 showing a normal life trajectory for vital function and life expectancy of an "average" individual in the population, depending on whether that individual is associated with a selected risk factor α. As with regard to the aggregate for the entire population, it is difficult to determine from a specific single measurement just where on either response curve R1a 212 or R1b 213 the individual should be assessed. Depending on whether the value of α is known for an individual, it may also be difficult to know whether the individual should be placed on response curve R1a 212 or R1b 213. Measurements of several risk indicators taken over time may yield information on whether a specific individual should be placed in category R1a 213 or the higher risk category R1b 212. The general concept of using time-dependent information to determine risk along is also illustrated in Figure 5.

The client device 110 determines information from which the server device 120 or the data review element 130 can analyze the time varying nature of data. The server device 120 or the data review element 130 can therefore determine both of the following:

- (1) just where on either response curve R1a 212 or R1b 213 the individual should be assessed; and

- (2) whether the individual should be assessed on the response curve R1a 212 or the response curve R1b 213.

It is to be noted that the above analysis has been condensed to 2-dimensions for convenience in presentation, with a single measurement along a single X-axis or Y-axis. In a preferred embodiment, a measurement would have many attributes, i.e. the model would have N-dimensions, and more sophisticated techniques for analyzing trends and achieving objectives are used.

If the data for the population is not known for all individuals in the population or subpopulation of interest, the server device 120 transmits a new set of information-gathering instructions (such as questions and suggested answers) to the client device 110, so as to measure that information individually for each patient 111.

Dynamic Modeling and Risk Evaluation

Figure 3a shows a process flow diagram 300a for a method with steps of dynamically collecting information 310, choosing to verify or update the model or to create new model 320, verifying 350 or updating 330 the risk assessment model or creating a new model 340, deciding whether to re-evaluate risk 360 and re-evaluating risk based on updated information and current model 370.

Dynamic Data Collection for Population

Figure 3b shows a process flow diagram 300b of a method for dynamic data collection to be performed by the system. This data collection may be done periodically or aperiodically, upon a triggering event or decision by the expert operator. The population or subpopulation from which to collect data is selected 380. The selection criteria may be based on preset values or may be set by the expert operator. The set of risk indicators or other information to be collected is selected 382, based either on preset values or decision by the expert operator. The individuals in the subpopulation of interest are queried 384 as to the information of interest and the database is updated 386. The pre-query steps need not be done in the order indicated.

Verification of Existing Model and Update of Model

Figure 3c shows a process flow diagram 300c of a method by which the updated data can be analyzed to determine whether the existing model is consistent with the

updated data; that is, to verify that the data conforms to the model within acceptable variation or error. This is accomplished by putting the updated data into categories 390, determining the updating measures of life vitality or costs 392, determining the values predicted by the model 394, comparing the updated measures of life vitality or costs against those predicted by the model 396, and determining whether the comparison is acceptable 397. If the predicted value is within an acceptable distance from the updated values based on well known measures such as statistical error, then the model need not be adjusted. The expert operator may also visually determine whether the updated data and existing model show an acceptable relationship to each other.

Figure 3d shows a process flow diagram 300d of a method for updating the existing risk model in response to updated information. By updating, it is meant that no new risk indicators are added, and no new external constraints on the model are added. The risk model to be adjusted may be for the aggregate population or for various subpopulations. The updated information for the subpopulation is categorized 398 according to profile information into one or more existing categories. The subpopulation is categorized according to one or more existing measure of life vitality or medical expense. Statistical analyses as described below or in other patents or patent applications previously incorporated by reference or as known in the art of statistics are applied to determine updated values for model parameters such as weights to give each factor 399.

was asked of the client but was not previously known to be a significant predictor, or it may be a new factor that is generated by combining other pieces of data. Figure 4b is a process flow diagram of the above steps.

In addition to data mined from the database, in creating a new model, scientific information well known in the literature may supplement the data.. For instance, scientific information regarding certain well studied correlations be considered such as known correlations of time since quitting smoking and various health conditions, known information regarding the shape of life expectancy curves for certain types of cancer patients, or recent information regarding efficacy of new forms of treatment for diseases such as recent significant improvements in treatment of AIDS.

Statistical analyses are known in the art of statistics, and include correlation analyses, multivariate regressions, constrained multivariate regressions, or variance analyses, may also be run on the data to reveal statistical relationships among the various information or measures of life vitality or medical expense in order to improve the predictive power of a model, although in a preferred embodiment data mining is done as presented in the preceding paragraphs.

Modeling and Scoring Risk Assessment; Insurance Pricing

Modeling risk is performed by assigning risk to individual in response to risk factors identified for that individual, and such modeling may be done for the population or for a subpopulation. There are many techniques for modeling, such as linearly risk scoring by assigning a number to each risk factor and adding up each number to determine a total risk score, non-linearly assessing risk by combining risk factors non-linearly to determine risk which may be achieved by neural network techniques which are known in the art of neural networks, or other techniques.

Figure 5 shows a diagram 500 including a first axis X 502 and a second axis Y 503 and a response curve R0 501, similar to that shown in figure 2. It shows several measurements of vitality with error bars 511 of an individual taken at several different points in time. Each measurement of vitality is taken at a later time from left to right. Information about the time varying nature of the measurements, or the trends, can improve the ability to predict future vitality, including imminent sharp declines in vitality, as can been seen by visually examining the data over time or by using sophisticated statistical techniques to examine the data and trends in the data over N-dimensions.

Insurance pricing may be achieved from advantages in risk assessment. It is known in the art of actuarial analysis to assign price in response to risk.

Providing treatment options and information to each population member

Figure 6 is a process flow diagram 600 showing a method for providing treatment options and information to each member based on the information provided. Upon receiving information about the patient from the client 610, the server or expert operator may identify a risk group 620 and identify an appropriate medical protocol 630, the server may present one or more responses to the patient 640, including treatment options, advice or merely health information that would be useful to the patient, and the client device may be configured to use an appropriate medical protocol in interacting with the patient 650. It is known in the art of medicine that membership in a risk group may indicate appropriate treatment. This may be done from an automated, preset set of responses to individual queries made to the patient, on an aggregate of preset responses to queries, or by an expert operator.

Alternative Embodiments

Although preferred embodiments are disclosed herein, many variations are possible which remain within the concept, scope, and spirit of the invention, and these variations would become clear to those skilled in the art after perusal of this application.

Claims

1. A method for assessing risk for selected individuals in a population, said method including steps for

determining, at a first time, a first set of risk indicators for said selected individuals;

collecting, at a second time after said first time, information about said selected individuals;

determining, at said second time, an additional risk indicator not in said first set, in response to said information;

assessing risk for said selected individuals in response to said additional risk indicators.

2. A method for assessing risk for selected individuals in a population, said method including steps for

determining, at a first time, a set of risk indicators for said selected individuals;

collecting, at a second time after said first time, information about said selected individuals;

adjusting, at said second time, at least one of said risk indicators in response to said information;

assessing risk for said selected individuals in response to said adjusted risk indicators.

3. A method as in claim 2, wherein said risk indicators include genetic risk indicators, medical risk indicators, environmental risk indicators, or behavioral risk indicators.

4. A method as in claim 2, wherein said steps for collecting include steps for collecting, at said second time, information for said selected individuals about a set of consequences associated with said risk indicators.

5. A method as in claim 2, including steps for determining a statistical measure of relation between at least one said risk indicator and said information about said selected individuals.

6. A method as in claim 2, including steps for determining a statistical measure of relation between at least two said risk indicators and said information about said selected individuals.

7. A method as in claim 2, wherein said steps for collecting include steps for

providing a client device for at least one of said selected individuals;

applying a measurement device to said one selected individual at said client device;

coupling said client device to a server device; and

transmitting a result of said steps for applying to said server device.

8. A method as in claim 2, wherein said steps for collecting include steps for

providing a client device for at least one of said selected individuals;

displaying questions at said client device; and

receiving answers to said questions from said at least one selected individual;

9. A method as in claim 8, wherein said steps for displaying include steps for

receiving said questions from a server device coupled to said client device;

timing said steps for displaying in response to a signal from said server device; and

transmitting said answers to said server device.

10. A risk-assessment model, said model including

a set of risk indicators for selected individuals in a population;

a first set of values associated, at a first time, with each corresponding risk indicator;

a set of information associated, at a second time after said first time, with said selected individuals;

a second set of values associated, at said second time, with each said corresponding risk indicator, said second set of values being determined in response to said set of information;

a risk-assessment, determined in response to said second set of values, for said selected individuals.

11. A financial product including

a set of risk indicators for selected individuals in a population;

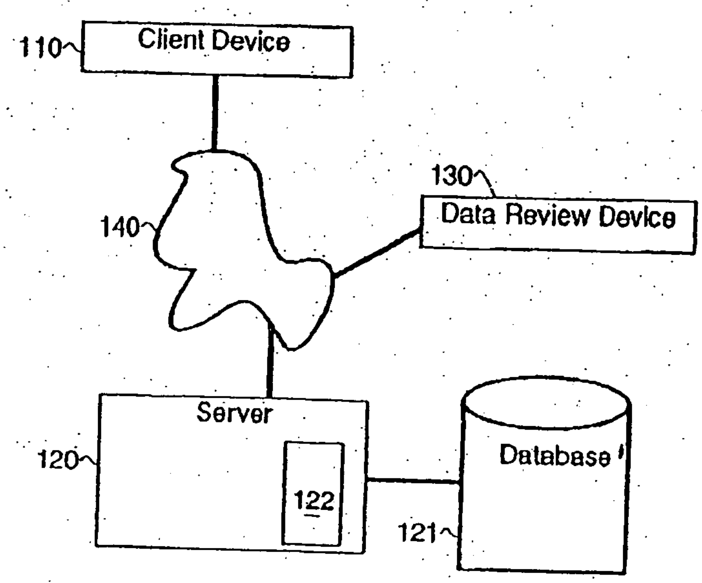
a first set of values associated, at a first time, with each corresponding risk indicator;

a set of information associated, at a second time after said first time, with said selected individuals;

a second set of values associated, at said second time, with each said corresponding risk indicator, said second set of values being determined in response to said set of information;

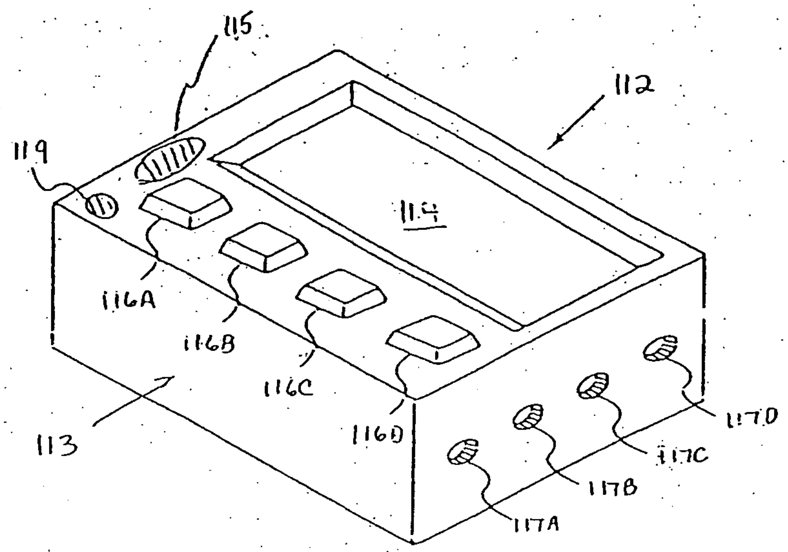
a pricing value, determined in response to said second set of values, for said selected individuals.

12. A financial product as in claim 11, wherein said pricing value is an insurance premium.



Client Device
110
140
130
Data Review Device
Server
120
122
Database
121

Fig. 1A



110 FIG. 1b

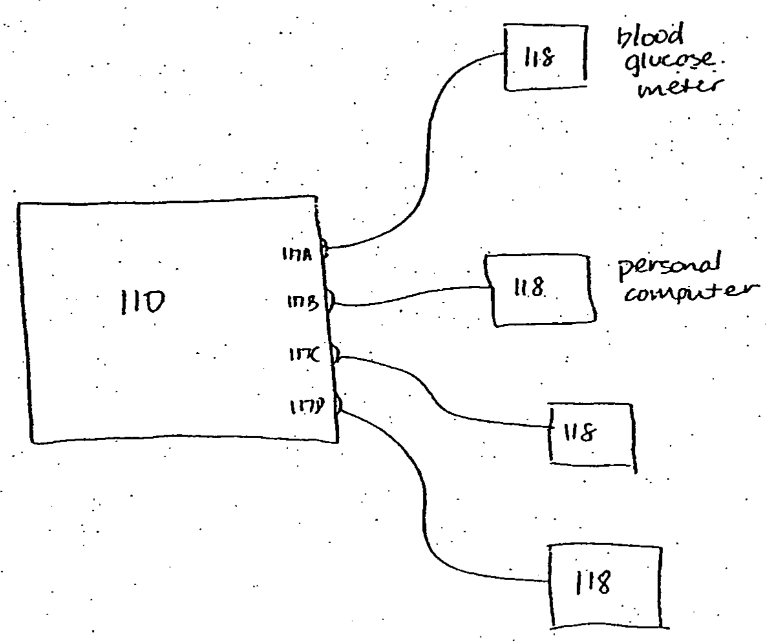

118
blood glucose meter
110
117A
117B
117C
117D
118
personal computer
118
118

Figure 1c

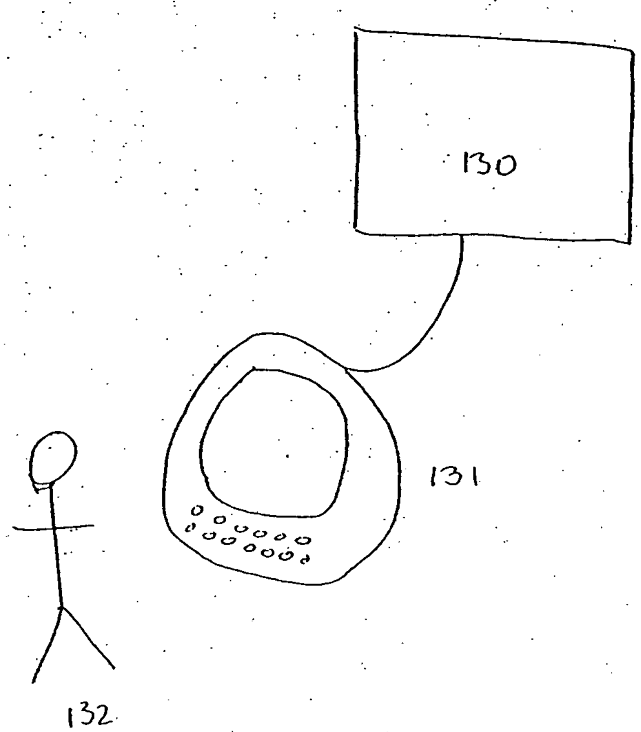


Figure 1d

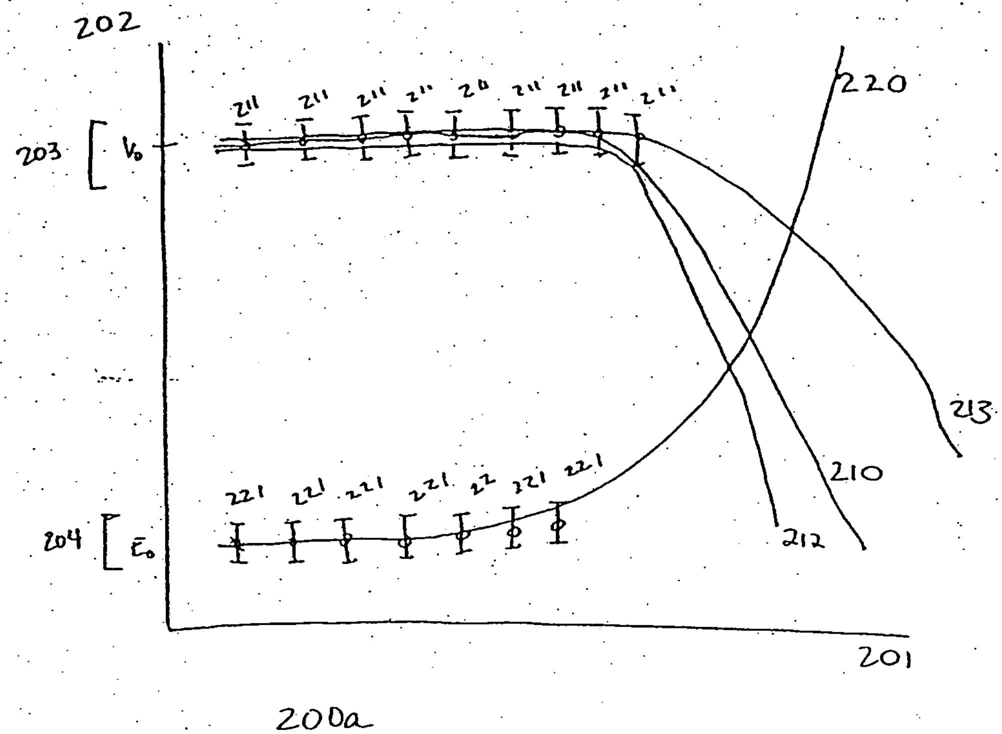


Figure 2A

PCT/US99/22019

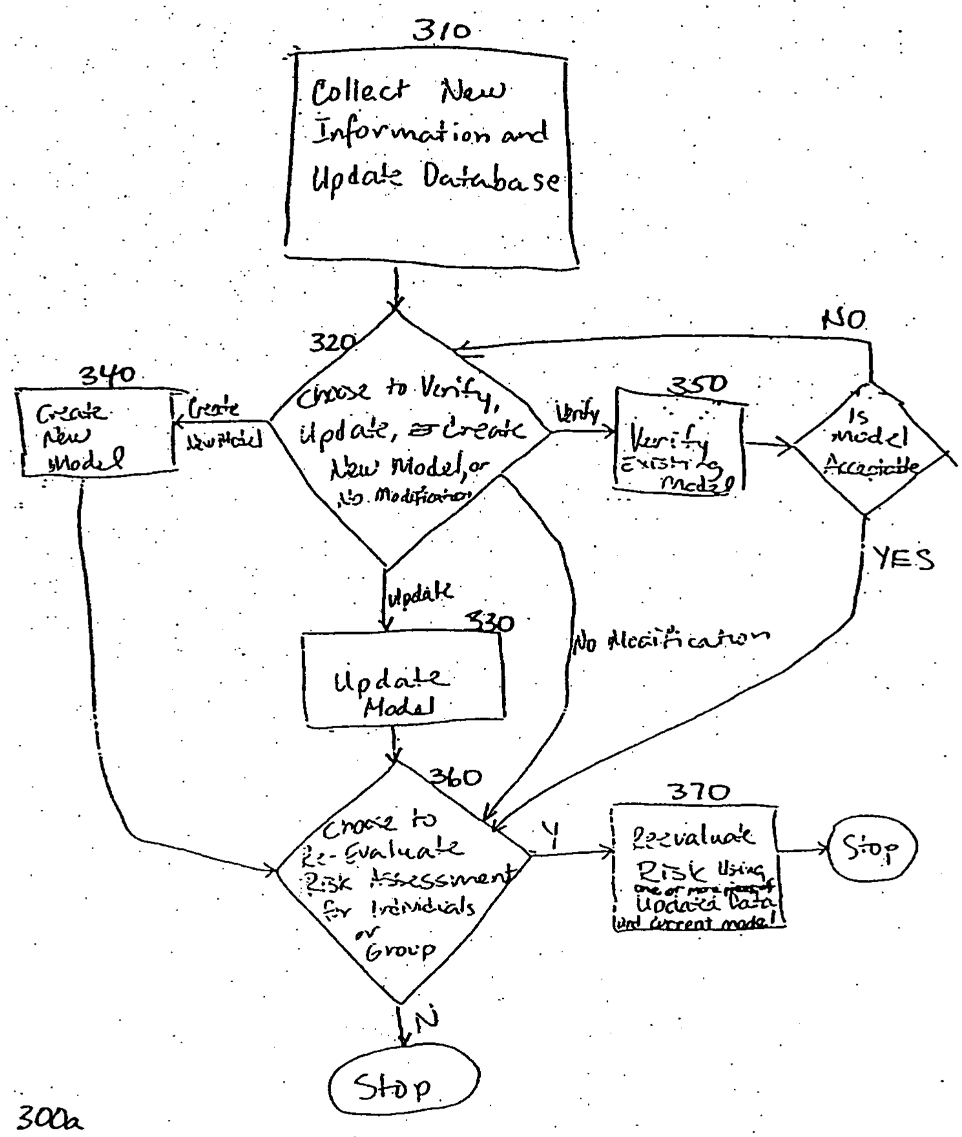
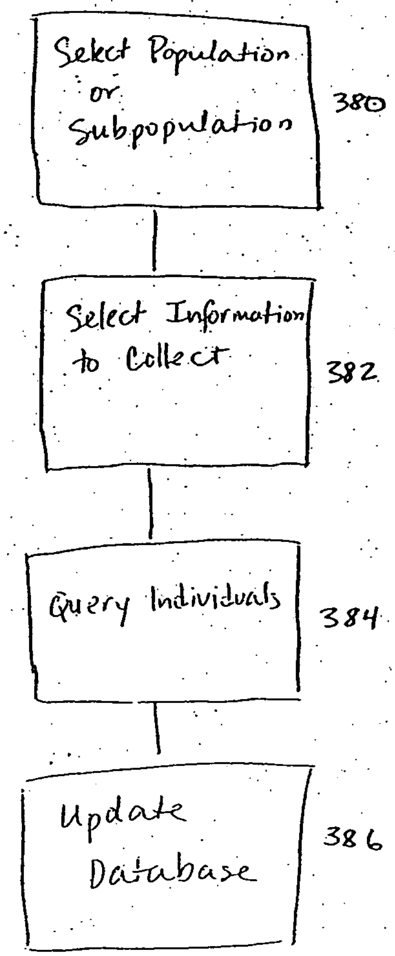
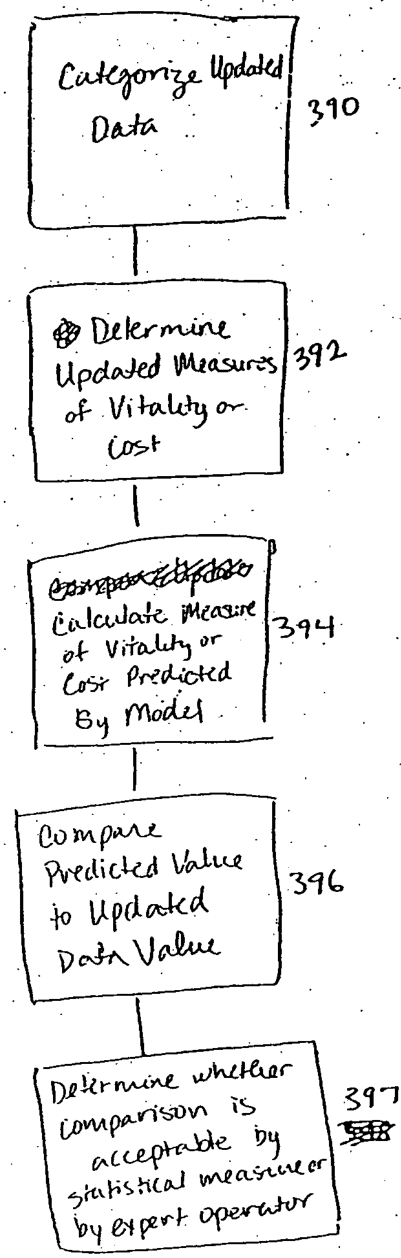


Figure 3a



300b

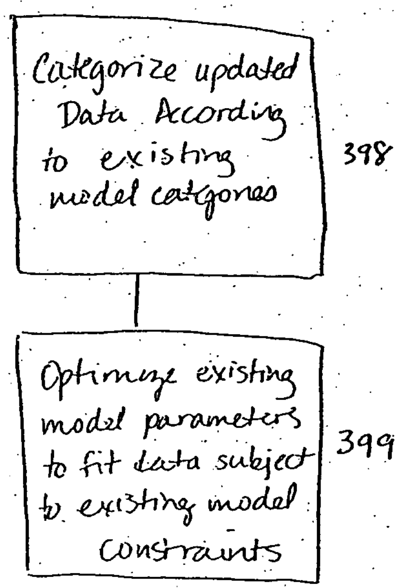
Figure 3b



300c

Figure 3c

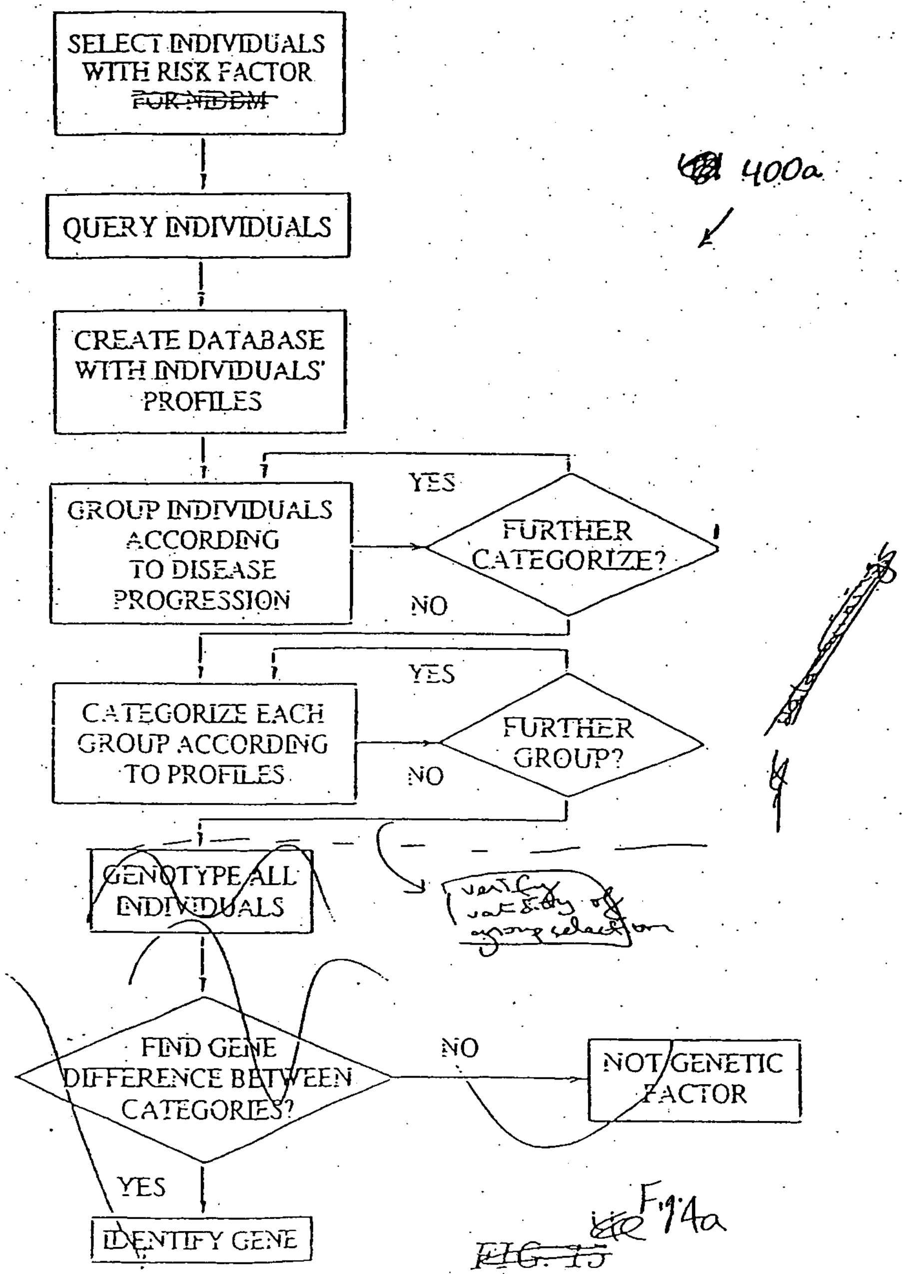
Verification



300d

Update Existing Risk Model
Figure 3d

400a



~~FIG. 15~~ Fig 4a

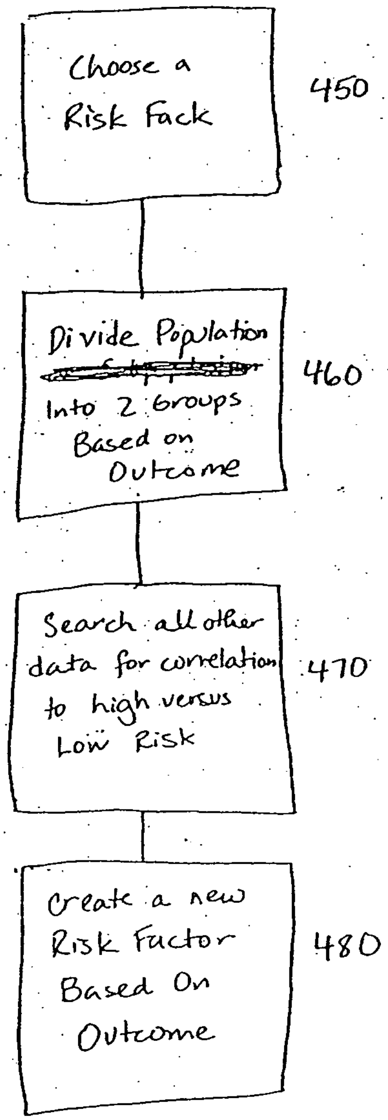

Choose a Risk Fack
450
Divide Population Into 2 Groups Based on Outcome
460
Search all other data for correlation to high versus Low Risk
470
Create a new Risk Factor Based On Outcome
480

Figure 4b

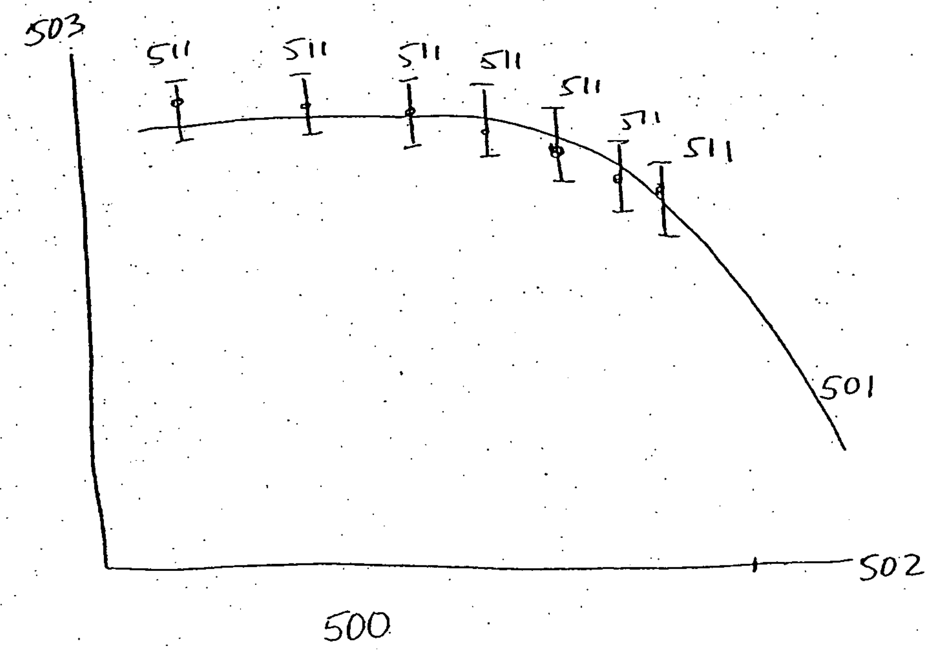


Fig. 5

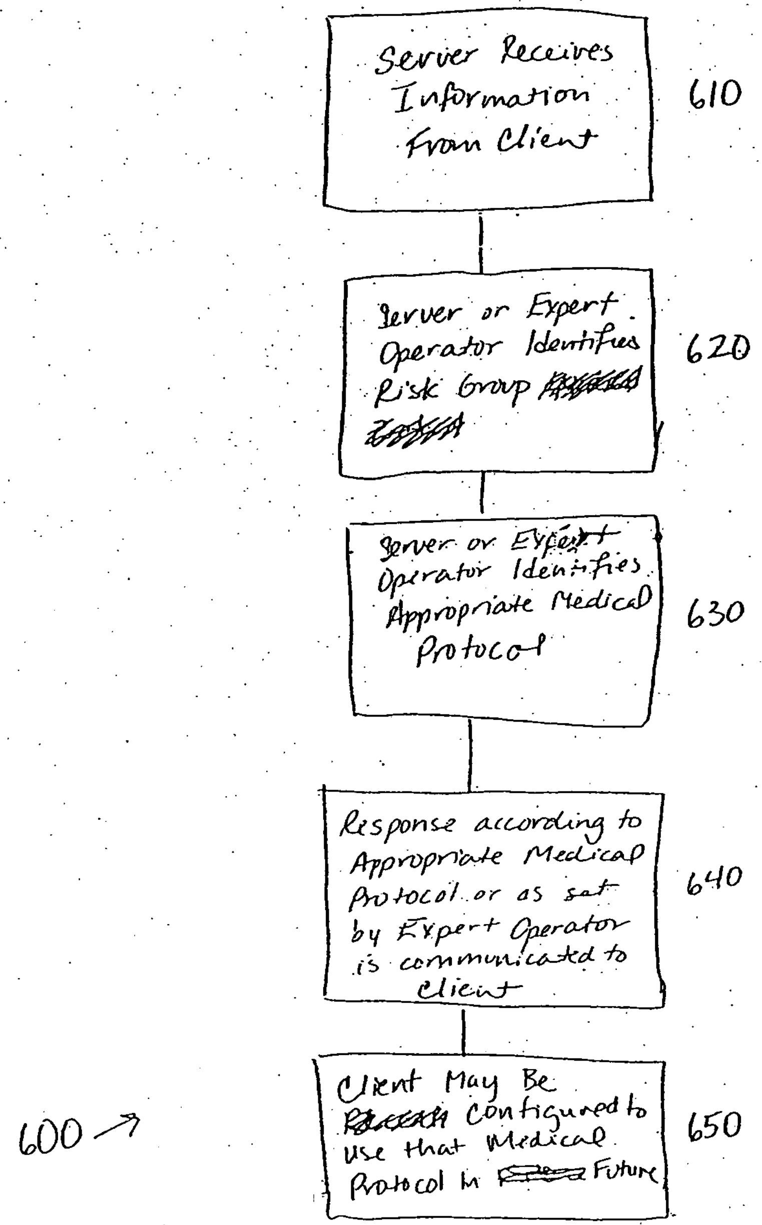

Server Receives Information From Client
610
Server or Expert Operator Identifies Risk Group
620
Server or Expert Operator Identifies Appropriate Medical Protocol
630
Response according to Appropriate Medical Protocol or as set by Expert Operator is communicated to client
640
Client May Be Configured to use that Medical Protocol in Future
650
600

Figure 6

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/22019

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06F17/60

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 700 009 A (MINGUIJON PEREZ SALVADOR) 6 March 1996 (1996-03-06) column 1, line 55 -column 2, line 54 ---	1-12
X	PALFREY T R ET AL: "Repeated insurance contracts and learning" RAND JOURNAL OF ECONOMICS, AUTUMN 1985, USA, vol. 16, no. 3, pages 356-367, XP000878736 ISSN: 0741-6261 page 356, line 17 -page 357, line 6 ---	1-4, 10-12

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 February 2000	25/02/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Pedersen, N

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/22019

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	BAEHRING T U ET AL: "Using the World Wide Web—a new approach to risk identification of diabetes mellitus" INTERNATIONAL JOURNAL OF MEDICAL INFORMATICS, IR, ELSEVIER SCIENTIFIC PUBLISHERS, SHANNON, vol. 46, no. 1, 1 August 1997 (1997-08-01), pages 31-39, XP004085528 ISSN: 1386-5056 page 34, column 2, line 1 -page 35, column 1, line 12 ---	1-10
P,X	MONTANI S ET AL: "Protocol-based reasoning in diabetic patient management" INTERNATIONAL JOURNAL OF MEDICAL INFORMATICS, IR, ELSEVIER SCIENTIFIC PUBLISHERS, SHANNON, vol. 53, no. 1, January 1999 (1999-01), pages 61-77, XP004158051 ISSN: 1386-5056 page 63, column 1, line 19 -page 64, column 1, line 11 ---	1-10
A	CLEMONS E K ET AL: "Information technology and information asymmetry: the future of private individual health insurance" PROCEEDINGS OF THE THIRTIETH HAWAII INTERNATIONAL CONFERENCE ON SYSTEM SCIENCES (CAT. NO.97TB100234), PROCEEDINGS OF THE THIRTIETH HAWAII INTERNATIONAL CONFERENCE ON SYSTEM SCIENCES, WAILEA, HI, USA, 7-10 JAN. 1997, pages 240-248 vol.3, XP002130528 1997, Los Alamitos, CA, USA, IEEE Comput. Soc. Press, USA ISBN: 0-8186-7743-0 page 240, column 2, line 40 -page 241, column 1, line 27 page 242, column 1, line 9 - line 27 ---	1-12
A	GB 2 231 420 A (AGENCY MANAGEMENT SERVICES INC) 14 November 1990 (1990-11-14) page 8, line 18 -page 9, line 5 -----	1-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 99/22019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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GB 2231420 A	14-11-1990	NONE	